and late evening hours. While drinking nectar, the passerines, and *Merops orientalis* contacted the stamens and stigma, effecting pollination. The other non-passerines caused damage to sex organs while probing the flowers for nectar. Further, they made punctures or holes at the flower base to drink nectar and also removed flowers to look for more nectar. Both categories of birds were regular visitors to *B. superba* until the flowers were exhausted. They made frequent visits to other trees of the same species in search of more nectar. The Indian Giant Squirrel (*Ratufa indica*), Bonnet Macaque (*Macaca radiata*) and Common Langur (*Presbytis entellus*) were also found to be regular visitors to the flowers of *B. superba*. The squirrel removed the basal part of the keel petals to access the nectar, thereby destroying the flowers. The monkeys plucked the flowers to eat the nectar-bearing part of the corolla. The flower-eating activity of all non-passerine birds, except *M. orientalis*, squirrels and monkeys were found to be detrimental to the reproductive success of *B. superba*.

B. superba flowers show ornithophilous floral characteristics (Faegri and van der Pijl 1979) — anthesis during the day, large, odourless robust flowers, bright orange-scarlet corolla, deep-seated, well-protected nectar and ovary, production of copious amount of nectar and the position of stamens and stigma away from the nectar location. The standard petal curves downwards, facilitating easy probing by birds. The keel petal is beak-shaped, holding the stamens and stigma inside, and overtops the other three petals. Further, the orientation and the arrangement of the flowers on the inflorescence help birds to probe them in quick succession. The leafless state of trees during flowering, makes the flowers more visible, and may help attract bird visitors, even from a long distance.

These bird-flowers attract both passerine and non-passerine birds. The passerine birds and the non-passerine *M. orientalis* effect pollination while probing the flowers for nectar. During probing, the birds cause the release of stamens and stigma from the beak-shaped keel petal and contact them on their beak and forehead. As the birds are far-flying and frequently move between trees of the same species in quest of nectar, they effect both self- and cross-pollination. The other non-passerines are not specialized flower-birds, but use *B. superba* flowers as a liquid source during the dry period, but in the process damage sex organs and also remove a large number of flowers daily, affecting reproductive success. Squirrels and monkeys use the flowers and contribute to a reduced fruit set rate. The hectic flower-feeding activity of non-pollinators on *B. superba* seen in our study appears to be a consequence of reduced or non-availability of their natural food sources due to degraded forest habitats with reduced biodiversity. Nevertheless, *B. superba* flowers serve as potential feeding stations for visiting birds, squirrels and monkeys during the dry season in the Eastern Ghats.

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27. SYNCHRONOUS SENESCENCE IN NEEM TREES IN BIJNOR AND JYOTIBA PHULE NAGAR DISTRICTS OF WESTERN UTTAR PRADESH [1]

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Neem (*Azadirachta indica* A. Juss.) is a polycarpic perennial, medium sized, deciduous tree having medicinal as well as insecticidal properties. It is cultivated all over India but thrives best in the drier climate of the north-western parts, where maximum temperatures get as high as 49° C (Anon. 1948). The optimum temperature for its growth, however, is 20-30° C. The Neem tree is described as evergreen because new leaves appear at the tips of branches immediately before

or after abscission of old leaves (Mohan Ram and Nair 1996). Thus, the tree shows sequential senescence controlled by internal factors, and the process becomes more prominent during the months of February and March, just before the initiation of the reproductive phase, every year. The abscission of older leaves helps the tree to conserve nutrients that are needed in large quantities during the reproductive phase. Neem trees cannot withstand waterlogged soils, frost and freezing or extended cold conditions (National Research Council 1992); however, they have occasionally withstood temperatures below 0° C in Dade County, Florida (Anon. 1980). Dogra and Thapliyal (1996) have reported that in the dry localities of India, Neem trees may shed all leaves for a brief period and, therefore, appear to be deciduous. The developmental processes, in general, are controlled by a number of phytohormones. Amongst them, auxins, gibberellins and cytokinins prevent abscission, while abscisic acid and ethylene promote abscission of leaves by forming an abscission layer (Dhami and Srivastava 2004).

Synchronous senescence (complete leaf fall), which is a common phenomenon in plants like Grapevines (*Vitis vinifera*), Peach (*Prunus persica*), Poplar (*Platanus orientalis*) and Pipal (*Ficus religiosa*), was also noticed in Neem trees (younger ones and even those more than 50 years old) in Bijnor and Jyotiba Phule Nagar districts of western Uttar Pradesh during the winter of 2003. To observe the phenomenon critically, Neem trees in residential areas, agricultural fields and along roadsides were marked, at four locations in Bijnor district and at five locations in Jyotiba Phule Nagar district. The observations were made at weekly intervals starting from the second week of January 2003 to the fourth week of April 2003. The trees denuded almost completely were considered synchronously senesced, and of them those that failed to bear new foliage were considered dead. The details of trees observed at different locations have been presented in Table 1. The results revealed that 173 trees out of 198 observed (87.37%) exhibited synchronous senescence. Later with the rise in temperature, by the fourth week of March 2003, sprouting of apical, auxillary and floral buds was observed all over the growing parts of these denuded trees, and thereafter these trees had the green foliage crown as before (Photographic evidence provided - Eds.). However, 8 denuded trees (4.62%) failed to survive.

It has been reported that there were repeated western disturbances as an upper air system, extending up to 4.5 km above msl, over north-east Rajasthan and Haryana, and over north Pakistan and Jammu & Kashmir and Punjab regions during the last week of December 2002 and throughout the month of January 2003. There was also an induced cyclonic circulation over the northern parts of Rajasthan, Haryana and western Uttar Pradesh. Consequently, severe cold wave conditions i.e. mean maximum temperature 15° C (7° C below normal), and mean minimum temperature 4° C (4° C below normal) prevailed in the western Uttar Pradesh up to the third week of January 2003. The total rainfall during the month of January 2003 was 22 mm – 4 mm above normal (Anon. 2003).

Table 1: Synchronous senescence in Neem trees in western Uttar Pradesh

Location	Number of trees		
	Observed	Synchronously senesced	Dead
District Bijnor			
Chandpur	28	24	1
Goyali	17	17	0
Pheena	31	24	3
Ratangarh	10	8	0
District Jyotiba Phule Nagar			
Amroha	27	26	1
Dhanaura	22	19	0
Gajraula	24	21	2
Naugaon	21	20	1
Shivala	18	14	0
Total	198	173	8
Mean	22.00	19.22	0.89
S.E.±	2.15	1.88	0.35

Since synchronous senescence is governed by environmental factors rather than internal factors (Dhami and Srivastava 2004), during January 2003, the severe cold spell coupled with frosty conditions throughout the month may be regarded as the stress factors, and the commencement of synchronous senescence in Neem trees as strain. In general, the low temperature range results in dehydration and frost injury to the protoplasm; also, the roots of temperate deciduous trees do not absorb sufficient water from soil. As a result it tends to reduce the rate of transpiration loss through abscission of leaves. Thus, at low temperatures, the production of phytohormones in Neem trees alters to save the plant from the adverse environmental conditions, and subsequently Neem trees exhibit synchronous senescence – a tolerance type of stress resistance.

The Neem trees survived severe cold and frosty conditions through alteration in the normal physiology by showing synchronous senescence, where functional capacity decreases and cellular breakdown increases temporarily. The observations made during subsequent years revealed that Neem trees showed usual sequential senescence and not the synchronous senescence. The reason may be that the cold waves did not prolong beyond a week, which were well tolerated by the Neem trees.

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28. OCCURRENCE OF A BI-CHAMBERED FRUIT OF THE RED SILK-COTTON *BOMBAX CEIBA*[1]

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During an outing at Sanjay Gandhi National Park, Borivli, I observed many fallen fruits of the Red Silk-cotton *Bombax ceiba* under a tree. While examining the fruits my attention was drawn to an abnormal bi-chambered fruit; the laterally formed fruitlet was approximately one third of the original fruit borne in the opposite direction; seeds with silk-cotton were present in both lobes.

Fig. 1: The bi-chambered fruit of the Red Silk-cotton *Bombax ceiba*

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